5/5/00 Final

U.S. Environmental Protection Agency
Science Advisory Board
Ecological Processes and Effects Committee

April 25-26, 2000

Minutes of the Meeting

Committee: The Ecological Processes and Effects Committee (EPEC) of the U.S. Environmental Protection Agency's Science Advisory Board (SAB) and consultants. (See Roster - Attachment A.)

Date, Time, and Location: Tuesday, April 25, 2000 (9:00 am - 5:30 pm Eastern Time) and Wednesday, April 26, 2000 (8:30 am - 3:30 pm Eastern Time), Conference Room 5530, Ariel Rios Building North, US EPA, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. (See Federal Register Notice - Attachment B.)

Purpose: To work on a Strategic Project to Develop and Apply a Framework for Reporting on Ecological Condition.

Attendees: In addition to SAB members and consultants listed on the Roster (Attachment A), Agency and other attendees are listed in Attachment C (Sign-in Sheets). The Designated Federal Officer for the Committee was Ms. Stephanie Sanzone.

Meeting Summary: The meeting followed the issues and general timing noted in the meeting agenda (See Meeting Agenda - Attachment D).

I. Welcome and Introductions

Ms. Sanzone led the panelists through a voluntary public disclosure process wherein panelists indicated their affiliation and research interests as they related to the Strategic Project. Dr. Young summarized the meeting objective as to suggest a framework for assessing, then reporting on, ecological condition. She reminded the Committee of Agency briefings on performance evaluation activities at EPA during an EPEC meeting in July of 1998, and explained the organization of the briefing notebook (See Notebook Table of Contents - Attachment E) that had been provided to the Committee for use at the present meeting.

II. Project Definition and Scope

The Committee agreed on a working definition of ?condition" as being equivalent to the ?state"

portion of the Pressure-State-Response (PSR) model, minus goods/services. Dr. Young also referred the Committee to the definitions of measures contained in the SAB's draft report, *Toward Integrated Environmental Decision-making*. The Committee agreed to consider goods/services only insofar as they are part of condition assessment.

The Committee discussed other similar efforts to develop ecological report cards, including the project being conducted by the Heinz Center and the recent NRC publication *Ecological Indicators for the Nation* (See Summary of NRC Ecological Indicators - Attachment F). Ms. Sanzone agreed to obtain a copy of the NRC report for members. Committee members voiced concerns that EPEC not duplicate existing report card efforts. After discussion, the Committee proposed that the EPEC project focus on aspects of ecological reporting that are not being well covered by other efforts (e.g., aspects of forest health, geomorphology, soil quality indicators), and "translate" scientific terminology into "plain English" statements of ecological condition. The Committee's framework list of Essential Ecosystem Characteristics will have explanations that are understandable to decision-makers and the public, and terms will be defined and used consistently.

The Committee agreed to include discussion in their report on the differences in philosophy underlying sustainability of ecosystems vs. sustaining goods/services flows, while noting that sustainable ecosystems are needed to support long-term sustainable flows of goods/services from those ecosystems. The Committee also agreed to discuss "disturbances" in terms of natural and anthropogenic changes to forcing functions (e.g., changes in frequency of fire, storm, and flooding events, as well as the influence of extreme events). Several members emphasized the importance of defining criteria for what makes a "good indicator," including guidance on scaling and expression issues.

The Committee defined potential outputs of the project as: 1) a hierarchical list of ecosystem attributes that should be considered when assessing ecological condition; 2) a framework for utilizing the list of attributes to develop, assemble, and organize information on ecological condition, and the relationship of the proposed framework to other well known frameworks (e.g., OECD, Heinz, ecorisk framework); and 3) illustrations of how the attributes relate to sample agency programs. These topics would be addressed in a 10-page report that could be read by the Administrator, the public, the program offices, and ORD (i.e., not aimed solely at technical audiences).

The Committee also discussed the importance of interpreting indicator data (e.g., status and trends relative to baseline or reference conditions, discussion of indicator variability) and of pointing out the limitations of relying on small sets of indicators to give "the answer"–i.e., there is no "magical index" that decision-makers can use to answer all relevant questions about ecosystem condition. Although in-depth treatment of these issues is beyond the scope of this project, the Committee agreed to devote some time at the next meeting to summarizing relevant questions surrounding interpretation of multiple indicators (either within or across EEC categories), referring as appropriate to previous EPEC reports on the topic.

III. Proposed Framework and Essential Ecosystem Characteristics

The Committee adopted a "working framework" that was modified slightly from Harwell et al. (1999) that emphasized the ecosystem science-based tiers (See Draft Proposed Framework - Attachment G). The Committee then discussed the EECs contained in Harwell et al. (1999), and made minor modifications to that list (See Draft List of EECs - Attachment H). Two over-arching categories of Pattern and Process were agreed to as a means of organizing the EECs and measures, although the Committee noted that pattern is a static look at a system (i.e., a snapshot), whereas process involves the trend in measures over time (i.e., rate measures). The Committee agreed that the framework should be complete, from an ecosystem science perspective, even if indicators (or data on indicators) currently are not available.

The Committee discussed the extent to which the spatial scale of interest (e.g., landscape, small watershed, or smaller ecosystem) affects the list of EECs that would be relevant, and agreed that the discussion of how to use the framework should make clear that spatial and temporal scales must be specified prior to designing a report card.

Several members were concerned with the use of value-laden terms such as "contaminant" or "nutrient" and suggested that a neutral term for chemical concentration or loading be used. The Committee agreed that information on stressors was an important complement to information on ecological effects in understanding the condition of ecosystems. For this reason, report cards should include both types of measures. The Committee agreed, therefore, that the EEC categories should be structured so that they could be adapted to aggregate both stressor and condition measures. The Committee's report will include a discussion relating common stressors of concern to the EEC categories. The Committee agreed primarily to focus on measures of condition, however, because these often are omitted or addressed incompletely.

With regard to disturbance regimes, the Committee agreed that these regimes should be discussed both in terms of their role in maintaining and regulating ecosystems, and their potential role as stressors when the regimes change as a result of human activity.

The Committee agreed to add consideration of climate characteristics (e.g., rainfall, temperature, wind) to the Harwell et al. (1999) framework.

On the second day of the meeting, Dr. Young led the Committee through a brief "road test" of the product EPEC is building to see how applicable it will be to Agency projects/programs. She reviewed the Agency's Government Performance and Results Act (GPRA) commitments that relate to ecological condition, watershed restoration and protection aspects of the National Environmental Performance Partnership System (NEPPS) program, and research goals expressed in the ORD Ecological Indicators Research Strategy. The Committee briefly discussed the import of the reporting framework they are developing in terms of ecological categories that should be covered to measure

progress toward GPRA and NEPPS goals. The Committee requested information on how other agencies have interpreted GPRA measures for ecological condition; Ms. Sanzone agreed to seek information on this and provide it to Dr. Pittinger as lead writer for this topic. The Committee also noted that it would be good to evaluate the completeness of the proposed framework by comparing it to one or more well-established ecosystem conceptual models.

IV. Case Examples to Illustrate Application of the Framework

Although the Committee did not have time to work through case examples at the meeting, it was agreed that this would be the focus of a subsequent meeting. The Committee identified the following attributes that should guide selection of case examples: differing scales (large vs localized), differing system types (aquatic vs. terrestrial), place vs. program, EPA involvement, comprehensive vs. more limited. Possible case examples discussed included: EMAP Western Pilot, the EMAP Mid-Atlantic Integrated Assessment, Big Darby Watershed, Willamette River restoration (a subset of EMAP Western Pilot), ORD/STAR ecological indicators work, the National Environmental Performance Partnership System (NEPPS), Index of Watershed Indicators, EPA's GPRA goal relating to healthy watersheds, the Chesapeake Bay Program, and the Forest Health Monitoring (FHM) program led by the USDA Forest Service.

The case examples would be examined in light of the proposed framework as a means of testing the framework's completeness and applicability to different programs and projects; the Committee's discussion of an example program/project would not constitute a formal SAB review of the program. The DFO was instructed to work with applicable EPA offices to determine the feasibility of briefings and interactions on case example choices for the EPEC meeting in September.

Possible "charge" questions to be addressed in case example write-ups: 1) how does the proposed EPEC framework compare to the program's proposed approach and coverage? 2) does the framework help to relate the program/project to EPA's mission to "safeguard the natural environment"? 3) are there things (ecological attributes) that EPEC would suggest are under-represented by the program/project's assessment of ecological condition? and 4) are there elements of the program/project that should be expanded in the proposed framework?

Case Example 1:
First Choice: EMAP Western Pilot
Second Choice : ORD/STAR eco indicators work (Research Strategy, STAR, Eco Research Strategy)

Case Example 2:
Forest Health Monitoring program

and/or Case Example 3:

Combination of GPRA/NEPPs as context for IWI and Big Darby

V. Next Steps and Writing Assignments

The following writing assignments were made, with reference to the Annotated Report Outline of 3/7/00 (See Attachment I):

Introduction: T. Young and S. Sanzone
Discussion of condition vs. goods/services approaches: B. Smith

Conceptual Framework: T.Young and S.Sanzone
Application Issues: "Problem formulation" including determination of appropriate scales and ecosystem types: T.Young
Relationship to other frameworks: revisions to the crosswalk table, T.Young, S.Sanzone

Essential Ecosystem Characteristics:
Habitat Structure: K. Cummins (DFO to ask V.Dale and C. Johnston to assist)
Water, Air, Soil Quality: B. Adams and B. Smith
Biotic Integrity: K. Cummins, P. Montagna
Ecol Processes: C. Gilmour, L. Alvarez-Cohen
Hydro/Geomorphology: T. Young, K. Cummins
Disturbance: B. Smith

Rationale for the EEC categories and how they relate to pattern/process and conceptual ecological models: L. Real

Stressors: The Parallel Universe (NEW SECTION): C. Pittinger

Scientific Issues Associated with Developing a Report Card: B. Adams, L.Real

Data and Information Management Issues: F. Taub, C. Johnston

<u>Homework Tasks Associated with Writing Assignments</u>:
1. Refine hierarchy set, as necessary (i.e., are the subcategories/entries the right ones? are they grouped appropriately? are they comprehensive?)
2. Definition/explanation for each category, subcategory, entry (for scientific and layperson)
3. Run past experts, check pre-meeting homework for ideas, check against other indicator systems, check against conceptual models etc (ROAD TEST)
4. Propose refinements (may need discussion by EPEC on call or next meeting)

Additional Homework: Matrices

All members were asked to complete 2 matrices for discussion at a subsequent teleconference meeting of the Committee: 1) EECs vs. three types of ecosystems (watershed/aquatic, forest, and rangelands) to check the applicability and completeness of the EECs for different system types (See Attachment J); and 2) EEC/Subcategories vs. varying spatial scales (national/ecoregional; regional/landscape; local; reach/stand) to note the relevancy of EECs at each spatial scale (High/Low/Not Applicable) and the temporal scale at which measures would be meaningful (i.e., the temporal scale of expected change in measures) (See Attachment K). The matrix exercise also is intended to help members think through issues surrounding their writing assignments.

Schedule for Next Steps:

Writing Assignments to S. Sanzone by June 5.
Matrices to S.Sanzone by June 14.
Teleconference Meeting, June 19 (1:00 pm -3:00 pm Eastern Time)
Teleconference Meeting, July 25 (12:00 -2:00 pm Eastern Time)
Meeting, September 20-22, 2000 (probably in Washington, DC)

The meeting was adjourned at 3:30 pm on April 26, 2000.

I certify that these minutes are an accurate account of the discussions held at the meeting.

/s/
Stephanie Sanzone,
Designated Federal Officer

/s/
Dr. Terry F. Young, Chair
Ecological Processes and Effects Committee

List of Attachments

Attachment A: Committee Roster
Attachment B: Federal Register Notice
Attachment C: Meeting Sign-in Sheets
Attachment D: Meeting Agenda
Attachment E: Committee Briefing Notebook Table of Contents
Attachment F: Summary of Ecological Indicators from NRC's *Ecological Indicators for the Nation*
Attachment G: Draft Proposed Framework for Reporting on Ecological Condition
Attachment H: Draft List of Essential Ecosystem Characteristics
Attachment I: Annotated Report Outline (draft dated 3/7/00)
Attachment J: Draft Matrix Relating EECs to a Sample of System Types
Attachment K: Draft Matrix Relating EECs to a Variety of Spatial Scales

Attachment A. Committee Roster

U.S. ENVIRONMENTAL PROTECTION AGENCY
SCIENCE ADVISORY BOARD
ECOLOGICAL PROCESSES AND EFFECTS COMMITTEE

April 25-26, 2000

CHAIR
Dr. Terry F. Young, Environmental Defense (previously EDF), Oakland, CA

MEMBERS
Dr. William J. Adams, Kennecott Utah Copper Corp., Magna, UT

Dr. Lisa Alvarez-Cohen, University of California-Berkeley, Berkeley, CA

Dr. Kenneth W. Cummins, CA Cooperative Fishery Research Unit and Fisheries Dept., Humboldt State University, Arcata, CA

Dr. Cynthia C. Gilmour, The Academy of Natural Sciences, St. Leonard, MD

Dr. Paul A. Montagna, Marine Science Institute, University of Texas at Austin, Port Aransas, TX

Dr. Charles A. Pittinger, Procter and Gamble Co., Cincinnati, OH

Dr. Leslie A. Real, Department of Biology, Emory University, Atlanta, GA

Dr. Frieda B. Taub, School of Fisheries, University of Washington, Seattle, WA

CONSULTANTS
Dr. Mark A. Harwell, Rosenstiel School Marine and Atmospheric Science, University of Miami, Miami, FL

Dr. William H. Smith, School of Forestry and Environmental Studies, Yale University, New Haven, CT

SCIENCE ADVISORY BOARD STAFF
Ms. Stephanie Sanzone, Designated Federal Officer, EPA Science Advisory Board (1400A), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460

Ms. Mary L. Winston, Management Assistant, EPA Science Advisory Board (1400A), 1200

Pennsylvania Ave., NW, Washington, D.C. 20460

Attachment D: Meeting Agenda

Final Agenda

U.S. Environmental Protection Agency
Science Advisory Board
Ecological Processes and Effects Committee

Strategic Project: Developing and Applying a Framework for Reporting on Ecological Condition

Room 5530, Ariel Rios Bldg (North)
1200 Pennsylvania Ave., NW
Washington, DC

April 25-26, 2000

Tuesday, April 25

9:00am	**I. Welcome and Introductions** **Public Disclosure**	**Dr. Terry Young, Chair** **Ms. Stephanie Sanzone, Designated Federal Officer**
9:15am	**II. Proposed Project Scope** **A. Overview of Proposed Scope** **B. Committee Discussion**	**Dr. Young**
10:00am	**III. Discussion/Development of Framework** **A. Framework Hierarchy**	**Dr. Young/Committee**
10:30am	**Break**	
10:45am	**B. Essential Ecosystem Characteristics (EECs) And Subcategories**	
12:30pm	**Lunch (Working)**	
1:15pm	**C. Reality Check: Possible Applications of the Framework and Implications for Content/Design**	
2:00pm	**D. Continue Discussion of EECs/Subcategories**	
3:00pm	**E. Endpoints and Measures: Illustrative Examples**	

4:30pm **IV. Process Check and Planning for Case Studies**

5:30pm **Recess**

6:00pm **Committee Dinner Cruise**

Wednesday, April 26

8:30am **V. Case Examples to Illustrate Application of the Framework**
A. Case Example 1

12:00 noon **Lunch (Working)**

1:00pm **B. Case Example 2**

3:00pm **VI. Next Steps and Writing Assignments**

3:30pm **VII. Committee Writing Session**

5:00pm **Adjourn**

Attachment E. Briefing Notebook Table of Contents

EPEC Strategic Project: Developing and Applying a Framework for Reporting on Ecological Integrity

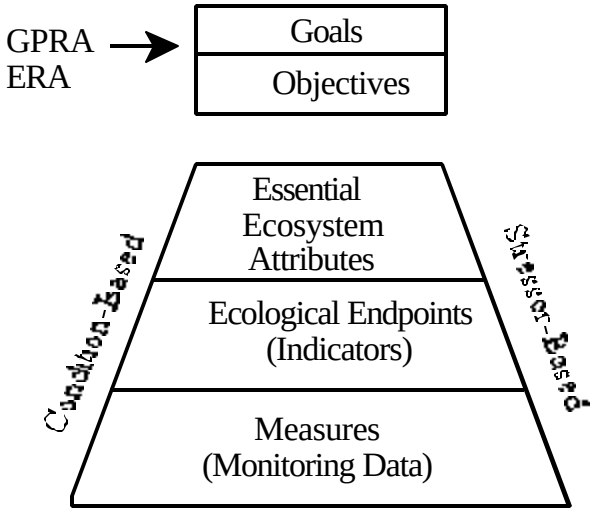
Notebook Contents:

EMAP Western Pilot
EMAP Mid-Atlantic Integrated Assessment (MAIA) Core Indicators
Chesapeake Bay Program (Overview and Indicators)

Tab 8 Annotated Bibliography of Indicator Programs and Reports

Overview of International Indicator Programs (Pittinger, 7/98)
Inventory of Government Literature on Report Cards (V. Myers, 1997)
Communicating the Condition of Terrestrial Ecosystems (Excerpt), ICF Kaiser, 1998

Attachment G: Draft Working Framework



Attachment H: Draft List of Essential Ecosystem Characteristics

(S.Sanzone's interpretation/guesses based on the meeting flipcharts–feel free to correct)

Hierarchy Key:

I. Major EEC Category (6)

A. Subcategory (5-7)

1. entries (approx 2)

(example indicators/endpoints)

I. Habitat Structure (Quality) (Condition)

A. Spatial Extent of each habitat type (Discuss coarse and fine-scale habitat to catch **?**dominant veg. type" down to **?**gray wolf habitat" or other species-specific habitat.)

B.Landscape Mosaic/Landscape Pattern

1. landscape connectivity / fragmentation
2. diversity of habitats

C. Within-habitat Structural Diversity

II. Physical/Chemical Characteristics for Water, Air, Soil, Sediment

(Use a table/matrix to show which items relevant for each media)

A. Physical

(e.g., porosity, conductivity, temperature, oxygen, turbidity, soil bulk density)

B. Chemical

(e.g., contaminants/nutrients, pH, organic matter, redox potential)

III. Biotic Integrity

A. biodiversity--biodiversity at all levels

1. genetic diversity

(e.g., genetic variation within a population)

2. species diversity

(e.g., species richness, racial diversity)

3. community diversity

(e.g., number of populations, things assessed in GAP analyses)

4. ecosystem variations

B. Biotic Composition:

1. species level (e.g., commonness/rarity)
2. population level (e.g., genetic diversity)
3. community level (e.g., community composition, community diversity)
4. ecosystem level

C. Trophic Structure

1. presence/abundance of key (regulating?) species (?)

(eg., keystone species, top predators, pathogens, bacterial/mycor. groups in soils)

D. Special Status Species

1. threatened/endangered/protected/rare species
2. pathogenic species
3. exotic/invasive/noxious species

E. Biological Condition (?): toxicity?

(Placeholder for a discussion of means of aggregating/reporting information on biotic integrity, including IBI, Functional Analysis, and Life Cycle Analyses)

IV. Ecological Processes

A. Ecosystem processes: Net Productivity

1. balance between heterotrophy and autotrophy (measured by oxygen demand) or between primary and secondary productivity (assessed via chlorophyl and fish biomass)]
2. decomposition rates
3. methanogenesis

B Ecosystem processes: biogeochemical cycling (via mass balance)

1. nitrogen cycling
2. sulfur cycling
3. CO2 cycling (biotic and abiotic)
4. phosphorus cycling
5. trace metals in some systems

C. Ecosystem processes: limiting factors (nutrients)?

D. Ecosystem processes: (chemical) loadings from one system to another

E. Community Processes: spatial and temporal dynamics of communities

[e.g., succession, patch dynamics (island biogeography is a tool for looking at that]

F. Population Processes

1. life history dynamics (e.g., changes in population age distribution)
2. colonization, exterpation, and extinction

(e.g., local reproduction rates, local minimum viable populations)

3. genetic differentiation

V. Hydrology/Geomorphology (to be developed by Dr. Young based on EPEC discussion)

VI. Disturbance Regimes (Maintainance of Natural Disturbance Regimes) (Alteration of Natural Events)

(Regime defined to include: extent, frequency, intensity, duration)

A. fire regime (fire suppression could be a leading indicator of change in succession, etc)
B. flooding regime
C. drought regime
D. storm regime (including winds associated with storm events)
E. other physical disturbances (e.g., earthquake, volcanic eruption)--other outlier events?
F. disease/pest outbreaks: pathogens, vectors
G. exotic species (or include under F, above)

Attachment J: Draft Matrix Relating EECs to a Sample of System Types

Questions: Is the Framework list of EECs applicable to a variety of systems types, or is in watershed-focused only? Are there other categories of EECs that would be needed to assess the condition of non-aquatic systems?

Instructions: Enter examples of entries or indicators/endpoints or "Not Applicable."

EEC		watershed/aquatic	forest	rangelands
Habitat Structure				
	spatial extent			
	landscape mosaic/landscape pattern			
	diversity of habitats			
Physical/Chemical Characteristics (for Air, Water, Sediment, and Soil)				
	physical			
	chemical			
Biotic Integrity				
	biodiversity			
	biotic composition			
	trophic structure			
	special status species			
	biological condition			
Ecological Processes				
	net productivity			
	biogeochemical cycling			
	community processes			
	population processes			
Hydrology/ Geomorphology				
Disturbance Regimes				

Attachment K: Draft Matrix Relating EECs to a Variety of Spatial Scales

Questions: Is the EEC hierarchy the same irrespective of spatial scale?

Instructions: Enter High, Low, or Not Applicable for EECs at each spatial scale. Where applicable, indicate the temporal scale of expected change (≤ monthly, annual, decadal, > decadal)

Examples at Each Spatial Scale: ecoregion scale(1000 km2), regional landscape scale (100 km2) (e.g., SF Bay Delta and Tributaries, Great Lakes Basin, MAIA, Everglades Basin), local (10 km2) (small watershed, ecosystem), reach or stand (<=1 km2)

EEC		Ecoregion scale (~1000 km^2)	Regional Landscape scale (~100 km^2	Small Watershed/ Ecosystem Scale (~10 km^2)	Reach or Stand (≤ 1 km^2)
Habitat Structure					
	spatial extent				
	landscape mosaic/landscape pattern				
	diversity of habitats				
Physical/Chemical Characteristics (for Air, Water, Sediment, and Soil)					
	physical				
	chemical				
Biotic Integrity					
	biodiversity				
	biotic composition				
	trophic structure				
	special status species				
	biological condition				
Ecological Processes					

	net productivity				
	biogeochemical cycling				
	community processes				
	population processes				
Hydrology/ Geomorphology					
Disturbance Regimes					